Dynamics of genetic organization: Hematopoietic system

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The collective behavior of all genes and chromosomes is based on both spatial (arrangement of chromosomes within the nucleus) and expression-level self-organization, which ultimately determines the function of a cell. We studied spatial organization by simultaneous detection of all chromosomes using spectral karyotyping (SKY). The co-regulation occurs between networks of genes within a chromosome (the *cis* interaction), but co-regulation may also occur between domains on different chromosomes or between distant domains on the same chromosome (the *trans* interaction). By combining analyses of gene expression patterns across the genome with spatial characterization, we have developed a more complete picture of coordinated gene regulation and organization of the genome during cellular differentiation. Finding patterns of coordinated gene regulation will allow us more fully understand the process of cellular differentiation within the hematopoietic system, which has vital implications for the genetic risk of blood cancers and their treatments.